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DISEASES OF THE NERVOUS SYSTEM

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DISEASES of the NERVOUS SYSTEM

(PUBLISHED MONTHLY)

A PRACTICAL JOURNAL ON PSYCHIATRY AND NEUROLOGY

Functional Electroencephalography in Mental Disorders*

W. T. LIBERSON, M.D.
Hartford, Connecticut

I. *Introduction.*

Two main lines of investigation have been followed by workers in electroencephalography as applied to psychiatry. First, there was an attempt to determine the types and the proportions of abnormal records in different groups of mental patients. Second, there was an endeavor to study the distribution of different characteristics of a normal electroencephalogram in those mental patients who do not present abnormal brain waves.

There are many mental patients whose electroencephalograms are normal, not only for "functional" psychoses, but also for certain organic mental diseases (neuro-syphilis: Finley, Rose and Solomon 1942; cerebral arteriosclerosis and senile psychoses: Hoch and Kubis 1941). However, there has been no general agreement concerning the significance and the percentage of different types of normal tracings recorded under standard conditions in mental patients. (Davis and Davis 1938; Jasper, Fitzpatrick and Solomon 1938; Rubin 1938).

The standard conditions of the electroencephalographic examination as defined by the concensus of workers are briefly as follows: eyes closed, no specific sensory stimulation, no definite mental or motor activity, but no actual drowsiness—a state of alert repose. However, it is questionable whether these conditions are most conducive to differentiation of mental patients with normal records, for: (a) one of the main characteristics of mental disease is the disturbance of responsiveness of the patients to changes in environment, especially under emotional stress; (b) there are many mental patients presenting a marked sleep disorder. Insomnia is one of the major symptoms observed in a great number of psychotics and psychoneurotics and an enforced lack of sleep can produce severe neurotic or psychotic symptoms in a normal individual. An analogy between dreamy states and some mental disturbances of psychotic patients has been suggested. This problem was emphasized in a recent paper (Worral 1941). On the other hand hallucinatory states have been described, due to focal lesions located in the vicinity of the regions involved in the regulation of sleep (Lhermitte 1931). The study of mental patients under drowsy and sleepy conditions is therefore of considerable interest.

It has been established that human electroencephalograms show systematic changes in different functional states (Berger). The alpha activity is depressed by sensory stimulation, particularly by visual stimulation; it is also depressed during mental work and under emotional stress. Individual differences observed concerning these changes in normal subjects have been reported (Liberson 1938 and 1941), and it may be assumed that patients with different mental diseases might be more easily differentiated under stimulation than under resting conditions. On the other hand, deep changes are observed in the human electroencephalogram during the drowsy and

*From The Institute of Living, Hartford, Con.

sleepy states. It was indicated that subjects with insomnia show a lower percentage of records with high alpha indices than the general population (Liberson 1937).

There was no research, however, devoted to the study of drowsy or sleepy patterns and the effect of stimulation in mental disease until a recent attempt to develop and apply a routine method of electroencephalography was conducted under various functional conditions (functional electroencephalography) in the Physiological Research Laboratory of the Institute of Living (formerly the Neuro-Psychiatric Institute of the Hartford Retreat). The method of functional electroencephalography was outlined (Liberson and Jasper 1942), and the early results concerning visual stimulation, as well as its clinical applications (Liberson, Jasper and Angus) were reported. The present paper contains, in detail, the experimental procedure and the analysis of results obtained from the study of a much larger number of cases with more careful selection of tracings.

II. *Technique*

A six-channel electroencephalograph is employed under a standard procedure with the use of the following set of electrodes:

First and second channels: Vertex-frontal regions (left and right);

Third channel: left frontal-left ear;

Fourth channel: Vertex-right ear;

Fifth and sixth channels: parieto-occipital regions (left and right).

The subject lies in a dark, sound-proof, electrically-shielded and air-conditioned room.

The electroencephalographic examination is generally conducted in the morning on fasting patients as follows:

1) *Drowsy State*—During the first 20-30 minutes the patient is not disturbed. As a result of this resting period, a state of drowsiness is induced in many cases. In these a continuous record is made until the stage of "spindles" is reached unless this does not occur within forty minutes. The visual stimulation is then applied.

2) *Visual Stimulation*—Consists of very brief flashes of light (about .1 second). A 300-watt light in a metallic reflector located 2 meters from the face of the subject is used. The reflector is directed upwards, so that the light is reflected indirectly upon the closed eyes of the patient.

At first, two flashes of light are produced, separated by an interval of about ten seconds. If, after the first stimulus, the subject opens his eyes, he is asked again to keep them closed throughout the examination. No mention is made of the forthcoming visual stimulation. After these two preliminary stimuli, repeated stimuli are delivered at a rhythm of one every two seconds. The total duration of intermittent visual stimulation is generally one minute and is followed by a simple psycho-motor test.

3) *Psycho-Motor Test*—The patient is asked to squeeze a rubber bulb each time he perceives a flash of light. During this trial the individual visual stimuli are more numerous and are separated by intervals of fifteen or twenty seconds. An intermittent stimulation is also applied in the same way.

4) *Mental Test*—The psycho-motor test is followed by a Serial 7's Test. In a limited number of cases a word-association test is used.

5) The examination is ended by the usual hyperventilation test lasting from two to three minutes. The focal abnormalities, if present, are then localized.

III. *Results*

Only results concerning (1) drowsy and sleepy patterns and (2) intermittent visual stimulation, are reported in this paper. The results concerning the other types of stimulation are on the whole analogous to those obtained with visual stimulation.

1. *Drowsy and Sleepy Patterns*

Much has been written about the electroencephalography of sleep and the different patterns have been described corresponding to its increasing depth (Loomis, Harvey, and Hobart 1937; Blake and Gerard 1937; Davis, Davis, Loomis, Harvey, and Hobart 1938; Blake, Gerard and Kleitman 1939). Our studies thus far have been confined to early stages of drowsiness and sleep. Our findings on the mental population are in general agreement with previous research with normal individuals.

Two aspects of the problem are considered in this paper: (a) proportion of patients with drowsy and sleepy patterns in various types of

mental disease; (b) proportion of each type of drowsy and sleepy pattern in different mental disorders.

Proportion of Patients with Drowsy Patterns in Various Types of Mental Diseases

Records of 945 patients were analyzed in order to determine the proportion of patients showing drowsy patterns. Thirty-seven per cent of this population have definite drowsy or sleepy patterns (with slow waves). This proportion varies significantly in different mental diseases.

The diagnoses were made at regular meetings by the medical staff. For each patient a requisition form was filled out by the referring doctor. This form included the following data: provisional diagnosis; history (brief abstract); special problem; medications and procedures which might affect the electroencephalogram; physical and neurological data; and mental state.

Table 1 shows the proportion of drowsy patterns according to various diagnoses. The highest proportion was found in manic patients (70%), a rather unexpected finding. A fairly high percentage, 50-55% was found in the depressive states (reactive depression, manic-depressive psychosis, depressed type, and involutional psychoses). Catatonic patients show the highest percentage (32%) among the schizophrenics and paranoid patients the lowest (20%).

Proportions of Different Types of Drowsy Patterns in Different Mental Disorders

In a previous paper various types of drowsy and sleepy patterns were defined (Liberson 1942). The following patterns seem to show the most significant correlations:

1) "Rapid Onset"—This pattern consists in the appearance of slow waves of drowsiness within the first 5 minutes of the EEG examination. Many patients show drowsy patterns as soon as they close their eyes.

2) "Microsleep"—In some cases bursts of "paroxysmal" sleep appear in the midst of well-defined alpha activity, without any preliminary change of the alert pattern (Fig. 1).

The duration of this "microsleep" may be only a second or two. By definition it is shorter than ten seconds. "Microsleep" often follows or appears during sensory stimulation and can be recorded only in the anterior leads.

It is important to differentiate this pattern from a burst of paroxysmal abnormality. Two features have to be considered from this point of view: (a) "Microsleep" is usually localized in the region of the vertex, showing a typical "phase reversal" in this region, while in most cases of "idiopathic" convulsive disorders, the "phase reversal" is observed, at least occasionally, in the pre-frontal leads (Fig. 2). (b) "Microsleep" usually shows in the course of a prolonged examination an increasing

TABLE 1

PROPORTIONS OF PATIENTS WITH DROWSY PATTERNS ACCORDING TO VARIOUS DIAGNOSES

Manic Depressive Manic		*Manic Depressive, Depressed*		*Involutional Melancholia*		*Reactive Depression*		*Toxic*		*Cerebral Arteriosclerosis and Senile*		*Involutional Paranoid*	
No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
49	70%	51	55%	111	50%	38	50%	50	38%	70	37%	29	34%

Psycho-Neuroses		*Psychopathic Personality*		*Schizophrenic Catatonic*		*Schizophrenic**		*Alcoholic Addiction*		*Schizophrenic Paranoid*		*Insomnia as Predominant Symptom (Any Diagnosis)*	
No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
88	33%	42	33%	59	32%	109	25%	134	25%	85	20%	32	69%

*Except paranoid and catatonic schizophrenics.

duration with finally an occurrence of a typical prolonged drowsy or sleepy pattern.

3) "Occipital Onset"—Generally drowsy patterns appear first either in the region of the vertex or in the ear electrodes. In some cases, however, there is a simultaneous onset of bursts of well organized slow activity of drowsiness in the occipital and the other regions of the brain. In other cases the occipital slow activity of drowsiness appears before the onset of any drowsy pattern in the anterior leads (Fig. 3). There are cases where the occipital region shows bursts of 4-6 per second activity of drowsiness 3-5 seconds after this activity has appeared in the vertex-ear electrodes (Fig. 4). The presence of well-organized slow activity of drowsiness in the occipital region before, simultaneously, or only a few seconds after the beginning of a similar activity in the vertex-ear electrodes has been

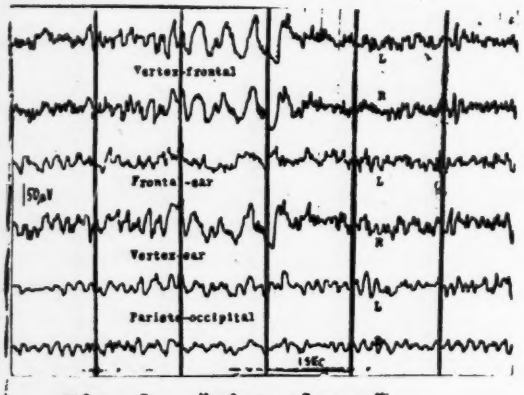

Fig. 1 - "Microsleep."
Note localization in region of vertex. Distance between vertical lines equal to 1 second.

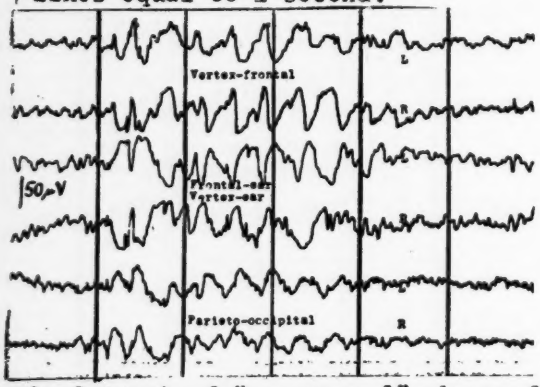

Fig.2-Burst of "paroxysmal" abnormality
Note "phase reversal" in frontal leads.
Distance between vertical lines equal to 1 second.

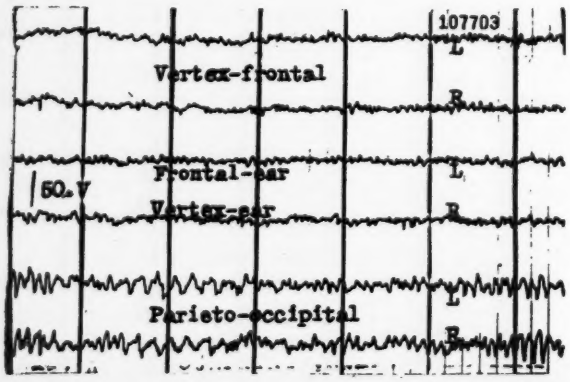

Fig. 3 - "Occipital onset."(See text)
Distance between vertical lines equal to 1 second.

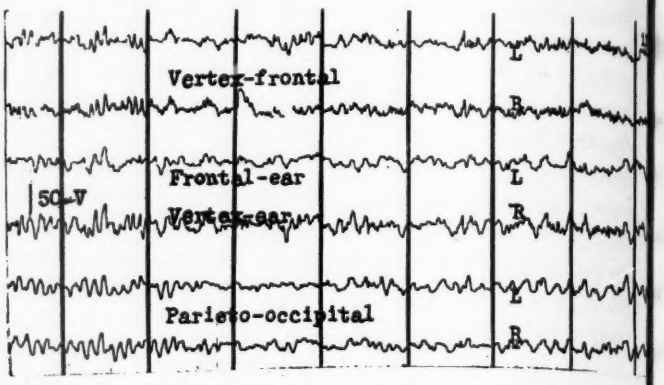

Fig. 4 - "Occipital onset." (See text)
Distance between vertical lines equal to 1 second.

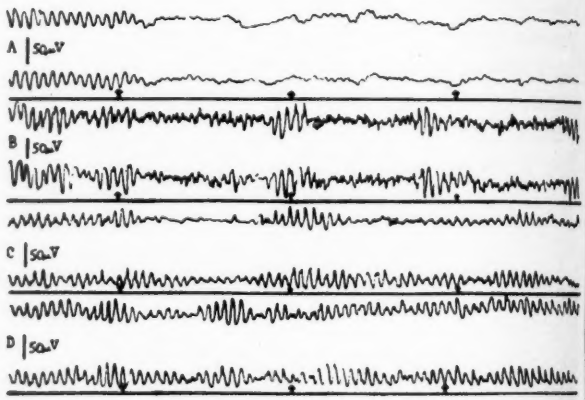

Fig. 5

Four types of reaction to visual stimulation in different subjects showing similar resting EEG's:

a) complete depression
b) intermittent depression
c) depression predominating on the left side
d) practically no reaction

Each of these four graphs was recorded on the parieto-occipital region (left and right).

Visual stimuli (every two seconds) are indicated on the graphs by arrows.

considered as characteristic of the "occipital onset" of sleep.

Table 2 shows the correlations between the various sleep patterns and clinical data. These findings can be summarized as follows:

a) "Rapid onset" is observed in 35% of records with drowsy patterns recorded in manic patients. A similar pattern is observed in 27% of arteriosclerotic patients, in 25% of patients with manic-depressive psychoses, depressed type, in 21% of catatonic patients and in only 4% to 5% of patients with either psychoneurosis or reactive depression. No case with "rapid onset" was observed among patients with either schizophrenia (besides catatonic patients) or with involutional paranoid psychosis.

b) "Microsleep" is observed chiefly in patients with involutional psychoses, arteriosclerosis, and manic-depressive psychoses, depressive type.

c) "Occipital onset" is observed mostly in cases with involutional psychoses.

Carrying the analysis of sleepy patterns still farther, Table 2 shows percentages of records with drowsy patterns with well organized "spindles" which are generally considered a definite indication of sleep. The highest percentages of records with "spindles" were found in psychoneurotic patients and those with manic-depressive psychosis, depressed type. The records of sleepy patterns found in manic patients show only 9% of tracings with "spindles" despite the high incidence of drowsiness in these patients.

2. *Visual Stimulation*

The same group of mental patients has been studied under visual stimulation. Only records with at least 50% alpha activity were analyzed. Four hundred and eleven records had to be eliminated because of delta activity, insufficiently developed alpha rhythm, persistent drowsy state or uncooperative behavior (eyes open). There were, therefore, 534 records studied.

Only data related to repeated stimuli and effects recorded in the occipital region are analyzed.

A. *Type of reaction* (Fig. 5). The estimate of the effect of the stimulation is based on the type of reaction and its duration. The stimulation effect is graded as follows:

(a) *Pronounced alpha reduction*—continuous complete or almost complete suppression of alpha activity for more than 10 seconds. In some cases the alpha suppression is seen throughout the visual test, despite the fact that there are only intermittent and brief stimuli. Pronounced intermittent reduction (following each stimulus) for more than twenty seconds.

(b) *Moderate alpha reduction*—Partial reduction, continuous or intermittent; or com-

TABLE 2

PER CENT OF DIFFERENT DROWSY PATTERNS IN VARIOUS TYPES OF MENTAL DISEASES

	"Rapid Onset"	*"Occipital Onset"*	*"Microsleep"*	*"Spindles"*
Manic-Depressive-Manic	35%	12%	3%	9%
Cerebral Arterio-Sclerosis	27%	4%	12%	8%
Manic-Depressive-Depressed	25%	14%	11%	25%
Toxic	21%	5%	0	21%
Schizophrenic Catatonic	21%	11%	5%	21%
Involutional Melancholia	18%	22%	14%	16%
Psychopathic Personality	14%	0	7%	22%
Alcoholic Addiction	10%	3%	0	15%
Reactive Depression	5%	11%	6%	16%
Psychoneurosis	4%	7%	4%	26%
Involutional Paranoid	0	20%	10%	13%
Schizophrenic Paranoid	0	0	0	17%
Schizophrenia	0	11%	4%	15%
Insomnia	14%	14%	14%	14%

Note: Same individual may show different patterns.

plete alpha reduction for less than ten seconds; or intermittent reduction for less than twenty seconds; also a unilateral reduction (generally on the left side).

(c) *Slight or no effect.*

B. *Correlation with clinical data*—Table 3 shows the number of cases with either pronounced, moderate, or slight alpha reduction, arranged according to clinical diagnoses. Moreover, the types of reaction were established for the cases with any diagnosis in which (1) anxiety was listed among the prominent clinical symptoms, and (2) depression was described among the main clinical data, without being associated with anxiety.

Table 3 reveals that the highest percentages of records with pronounced reduction of alpha activity under stimulation occur in psychopathic personalities (52%), in involutional cases (48%), and in patients with psychoneurosis, anxiety state and reactive depression (42%). The lowest percentages are found in arteriosclerotic patients (19%), manics (18%), patients with toxic psychoses (16%), and catatonics (15%). Patients with manic-depressive psychoses, depressed type, and schizophrenia except catatonics show intermediate values (27-30%).

Conversely, various groups of mental patients show different percentages of records with slight or no reduction of alpha activity. The highest percentages are shown by arteriosclerotic, catatonic and toxic patients (37%, 36% and 32%, respectively); the lowest percentages are shown by psychopathic personalities (13%) and by psychoneurotic patients (15%).

Patients with anxiety (regardless of diagnosis) show a relatively high rate (43%) with pronounced reduction of alpha activity under stimulation and only 23% of records with slight or no reduction of alpha activity. Patients with depression (not associated with anxiety and regardless of the diagnosis) show 39% of records with pronounced reduction of alpha activity under stimulation and only 19% with slight or no reduction.

The same table lists the number and the percentages of records with unilateral reduction of alpha activity under visual stimulation. This pattern is observed in every group of patients, particularly in schizophrenic, manic-depressive-manic, involutional and arteriosclerotic patients.

TABLE 3

VISUAL STIMULATION

	Number of Patients	*Per Cent of Patients with Pronounced Reduction of Alpha Waves*	*Per Cent of Patients with Moderate Reduction of Alpha Waves*	*Per Cent of Patients with Slight or No Reduction of Alpha Waves*	*Per Cent of Patients with Unilateral Depressions*	
					L.	*R.*
Psychopathic Personality	23	52	35	13	4	0
Involutional Psychoses	77	48	27	25	14	2
Reactive Depression and Psychoneurosis	97	42	43	15	9	0
Alcoholic	83	35	41	24	12	0
Manic Depressive Depressed	34	30	44	26	12	0
Schizophrenic Paranoid	45	30	45	25	11	2
Schizophrenic	73	27	48	25	21	0
Cerebral Arteriosclerosis	27	19	44	37	15	4
Manic Depressive Manic	17	18	14	18	18	0
Toxic Psychoses	19	16	52	32	11	0
Schizophrenic Catatonic	39	15	49	36	13	5
Anxiety (Symptom)	173	43	34	23	12	1
Depression (Symptom)	107	39	42	19	16	3

IV. *Discussion*

1) *Drowsy States*—In drowsy and sleepy states, unexpected results were obtained. Manic patients showed the highest proportion of records with daytime drowsy patterns. This finding seems to be partially related to the profound sleep disorder usually shown by manics. Indeed, patients with insomnia as a dominant symptom regardless of the diagnosis (see Table 1) show the same percentage of drowsy and sleepy patterns during the daytime examination as manic patients. However, the qualitative analysis of sleepy patterns shows differences between manic patients and the total group of insomniac patients. Thus "rapid onset" of drowsy patterns, observed in a considerable proportion of EEG's with drowsy patterns recorded on manic patients (35%), was relatively rare in the total group of insomniac patients (14%). On the other hand, manic patients show only 9% of sleepy patterns with "spindles;" they show therefore a pattern of relatively light sleep. Thus the determination of the type of drowsy pattern contributes to more penetrating differentiations among various groups.

It is amazing to find how determination of the proportion of mental patients showing daytime drowsy patterns makes it possible to group together different depressive states (involutional melancholia, manic-depressive psychosis, depressed type, and reactive depression). Here again there are qualitative differences between these various groups of depressed patients especially insofar as the pattern of "rapid onset" is concerned. This pattern was observed in 18-25% of psychotic patients and in only 5% of patients with reactive depression.

There is no available data concerning normal population examined under the same conditions as those described in this paper. From occasional observations of records taken on members of the personnel, it appears that the percentage of normal individuals with drowsy patterns occupies an intermediate place between the two extremes found in manic and paranoid (schizophrenic) patients of respectively 70% and 20% records with drowsy patterns.

It is suggestive that the responsiveness of these different groups of patients to various drastic treatments, particularly electric shock therapy, shows a positive correlation with the occurrence of sleepy patterns under EEG examination and therefore with sleep disorders. Manic-depressive psychosis, involutional melancholia and reactive depression generally show the highest percentage of recovery or improvement, whereas paranoid schizophrenia is usually resistive to the treatment.

2) *Visual Stimulation*—Individuals with the same resting electroencephalograms present considerable difference in the amount of alpha activity under visual stimulation (Fig. 5). The reductibility or resistivity of alpha activity is correlated with clinical data. Patients with arteriosclerosis, toxic psychoses and catatonic schizophrenia, show less reductible electroencephalograms than those presenting marked depressive or anxiety states, particularly with psychoneuroses and involutional psychoses.

The exact biological significance of the reductibility of alpha activity under stimulation is unknown. It can be assumed, however, that the adaptability of nervous mechanisms involved and diffusibility of excitatory states set in action under these experimental conditions contribute to the observed electroencephalographic effect. The present research suggests that these processes may be affected in the opposite direction by different mental diseases.

It is a fair inference that in many cases of patients with marked anxiety, diffusibility of excitatory states is greatly increased. The results are less clearly understandable with psychopathic personalities which show the highest percentage of reductible alpha activity. These results are, however, statistically less significant because of the relatively small number of such patients.

There are many patients who show under stimulation a predominant depression of alpha activity on one side, usually the left. This situation is related to the occurrence in the resting conditions of a bilateral difference between left and right parietal and occipital regions with less alpha activity on the left side (Strauss, Liberson and Meltzer, 1943) and is probably due to the dominance of the left hemisphere in most individuals despite the fact that we observed the same facts in left-handed individuals. An alternative hypothesis would be a defect in functional association between the right and left parieto-occipital regions in some individuals. Whatever the explanation for this phenomenon, our study

indicates its frequent occurrence in schizophrenic, manic, arteriosclerotic and involutional cases.

V. *Summary*

1) A technique of a routine electroencephalographic examination conducted at different functional levels is described. The functional states considered are: (a) drowsy and sleepy states, and (b) visual stimulation.

2) The highest proportion of "drowsy and sleepy patterns" found under prescribed conditions is observed in manics and insomniac patients (70%). Patients with depressive states (manic-depressive psychoses, depressed, involutional melancholia, reactive depression) also show a fairly high proportion of drowsy patterns (50-55%). Paranoid schizophrenics show the lowest percentage (20%).

3) The proportion of various types of drowsy patterns are considered in different mental diseases, permitting more penetrating differentiation of various groups of patients.

4) Patients with the same type of resting electroencephalograms show different degrees of reductibility of alpha waves under stimulation. The highest indices of "alpha reductibility" are found in functional psychoses and psychoneuroses, particularly those displaying depressive and anxiety states. The lowest are found in catatonic schizophrenia, in toxic psychoses and in arteriosclerosis. Thus functional electroencephalography makes possible a further differentiation of mental patients with the same resting electroencephalograms. While in general, schizophrenic, particularly catatonic, patients show less reductible alpha activity under stimulation, there are some who show a pronounced reduction of alpha activity under these conditions. It is of interest in these cases to find objective evidence of contact of the patient with the environment.

5) Although the functional electroencephalographic characteristics correlate with clinical findings, they do not permit classification of individual cases in present-day diagnostic groups. They contribute, however, to total psycho-biological evaluation of the personality.

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The Role of Food in Psychiatry*

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The subject psychodietetics, although a novel field in the realm of psychiatry and psychology, has appeared in the literature frequently in the last decade. Fritz[1] coined the title and segregated its application in 1933. Since then many authors have written about the relationship of food to mental processes—normal and otherwise. This writer[2] has, during the past two years, covered various phases of this important subject presenting material developed in research and investigation.

The psychiatric aspects of food and nutrition, although only a small part of the larger picture of how the human mind functions and the diagnosis and treatment of abnormality, are, nevertheless, contributing factors.

Psychodietetics is a sub-branch of psychology and psychiatry dealing primarily with the individual's approach to his nourishment. Since food is one of the three basic needs of man the importance of this subject cannot be over-emphasized. Out of the three needs, warmth, sleep, and nutrition, it would seem easier to find proper consonants for the first two than for the nutritional problem. One can sleep any place; one can keep warm by bundling with neighbors or can find shelter under a log. But the matter of eating in this complex civilization, particularly during wartime, involves individual differences, changes in social factors, changes in economic factors, including governmental regulation and variations in psychological attitudes.

For the past two years I have been interrogating cases at the Psychopathic Clinic of the Recorder's Court, Detroit, with special reference to food habits, fancies, eating procedures, and nutritional interests. The study was not undertaken merely because of the increasing problem in wartime. It was felt that nutritional psychology is a matter which should be thoroughly investigated from every possible angle in order to aid problem individuals, including psychotic and psychopathic personalities, in adjusting their attitudes and interests.

A food questionnaire was devised in which the answers reveal that a comprehensive picture of the individual's overall mental life can be gleaned from the individual's tastes in and reactions to food. From the type of food consumed, a picture of early childhood life can be drawn. The farm boy has different food interests from the youth of the same age who was reared on the "Gold Coast." Food questions offer important leads in investigating childhood attitudes and intrafamilial friction points. It requires little further proof to suspect that the boy who would not eat fish and whose mother would not eat fish shows some identification. It is necessary, of course, to find out whether this particular factor is the only food fad of both mother and son.

On the other hand, it seems to be a common observation among those who have had custody of orphans, refugees, and others who are socially, economically, and emotionally insecure to note that such persons have much greater appetites than normal even after the possibility of starvation has been removed. This may indicate that oversatiation with food is a symbol of security.

Along these lines a survey was made of two hundred individuals. One hundred of these were cases sent by draft boards of various parts of the City of Detroit because they had been rejected for neuropsychiatric reasons by their induction boards and were to be reclassified. Should their mental condition improve or the regulations have changed they would be returned to the induction board for reclassification. The other hundred were a miscellaneous group comprised of various traffic offenders, other law violators, and domestic relations cases. Roughly they represented a cross section of those living in lower middle and inferior economic conditions. There were no women included in either group.

The object of the study was to determine whether these individuals manifested their abnormal personalities or abnormalities in thinking in abnormal eating habits or whether they ate food typical of their economic group. Because of the widely diversified food interests, habits, and backgrounds of the members of the group, no statistical findings of signifi-

cance were determinable.

One interesting observation, however, was that out of about a quarter of the total who were definitely in low income and unemployed groups, a very small number showed diagnosable vitamin deficiencies of a mild nature. And, although a careful study was made of the thinking processes of these people, it seems extremely doubtful that any personality changes accompanied such vitamin deficiencies. On the other hand, it was obvious that the vitamin deficiencies were due to the same personality factors which caused the induction board to reject or caused their summons to court. For instance, individuals with low intelligence quotients whose traffic violations were due to the inability to learn to judge right from wrong behavior in traffic, i.e., the inability to learn and live within the traffic law, also showed the same ignorance in eating. Two feebleminded individuals who had kept out of traffic difficulty for a long time because they had learned proper behavior in traffic, showed that they were not abnormal. They might not know what a vitamin was or be able to apply a knowledge of vitamin physiology, but, because they had been well handled as children and trained to eat a reasonably well-balanced diet, they continued to do so as adults. The feebleminded individual, therefore, who is taught an eating routine without knowing its why and wherefore which he cannot comprehend, still may eat a well-balanced diet. The mental defective who is high enough intellectually to keep out of institutions but, because of his low intellect, is shiftless, has a poor industrial record, and gets into minor difficulties, shows the same type of behavior in his eating habits.

One traffic case of this sort comes to mind of a defendant who ate nothing but potatoes, bread, and butter for all his meals. He would consume large quantities of these foods and it is probable that because he ate ice cream and fruit sundaes on occasion to supplement this bizarre diet he did not show marked vitamin deficiencies. Butter, of course, provided Vitamin A and some D. Fruit syrups provided some C and the Vitamin B deficiency was probably latent and not obvious. His peculiar eating habits came from the fact that these were the easiest foods for him to get. He was living in a furnished room and could boil up potatoes, where he could not prepare other foods. He was not intelligent enough to follow recipes or to see the value of a varied diet. Meats were hard to prepare but he could smear a whole loaf of bread with butter, a slice at a time, and have a feeling of satiation. His lifelong conduct was similar. The only job that he knew was car-washing and he went from one car-washing job to another and was able to eke out a sufficient living to buy his bread and potatoes. But a crisis came. He had to drive a car to a part of the city with which he was unfamiliar and he violated a traffic ordinance resulting in his arrest.

The picture presented by the neurotics whom we examined for the draft boards is dramatic in that it shows that in most instances there is some food fad or bizarre behavior tied up with the neurosis. Out of eighty-two psychoneurotics, seventy-four had eccentric eating interests. While the diagnosis might have been made on the basis of compulsion or obsessive symptoms, nevertheless some of the compulsive behavior or obsessive reactions were tied up with food. How frequently do cases being treated by psychiatrists or seen in psychiatric clinics present these food problems? The signs are minimized, probably not even recorded, and certainly not studied because they seem to be only a minor part of the major psychopathological picture.

In our investigations, the first questions asked concerned the individual's food reactions rather than other neurotic symptoms. It is true that many of the rejectees had little desire of minimizing the neurosis for practically all of them would be glad of deferment. This group, perhaps, stands out in contradistinction to the neurotics who want to escape from their problems by getting into the armed forces or who wish to compensate for feelings of inferiority or even actual inadequacy by a compensatory attempt to dramatize themselves. It is probable, therefore, that the symptoms of anxiety or hypochondria or conversion mechanisms would have come out through routine questionings, but to one interested in food it was startling to see how dramatically the symptoms and even the mechanisms appeared when the food habits and interests were investigated. Case after case presented a picture something like this:

Q. Is there anything that you can't eat?

A. Yes (naming one or more articles).

Q. How long has it been that you couldn't eat these things?

A. Ever since I have had my stomach trouble. (The selectee then goes on to describe this in detail, giving symptoms which are obviously psychogenic and not due to any organic basis.)

Among the hundred rejectees it was surprising to find no one that said he had a diagnosable entity such as a gastric ulcer, etc. All complained of indigestion—"stomach trouble," "gas on the stomach," "things don't agree with me." Of course there is the possibility of allergies, but it was interesting to note how much the social pattern entered into the picture, for the foods which were allegedly indigestible were invariably cauliflower, cabbage and fat meats. In some instances it was found that distaste commenced in childhood. In one case there had been, in his youth, a hated sibling who was fond of meat and this rejectee told the psychiatrist that he "never did like meat." When questioned closely about what he ate during the day it was learned that he only completely refused "fatty meats." This dislike, however, was bizarre because he would eat pork sausage, surely more greasy than the pork chops which he decided would not agree with him.

After talking with nutritionists, I concluded that rejection of cabbage type vegetables and fatty meats was a social phenomenon. Hospital patients ill with an organic gastric condition and even with gall bladder disorders do not reject these foods. While the gall bladder patients may refuse gas-producing substances of all kinds because they find they get stomach pains, they do not necessarily find that the fatty meats and cabbage-type vegetables are difficult to digest. But traditionally, people believe that cabbage is "hard to digest," and that pork is a meat which is "hard to digest."

In spite of the fact that nutritionists laugh at the idea as a superstition that eating a combination of pickles and ice cream is detrimental, it occurred to at least twelve of the seventy-four complainers, and they claimed that their worst difficulties came on after eating pickles and ice cream. Because stomach trouble and heart trouble are the most socially acceptable illnesses (or because these are the most common) it was not surprising to record those claiming gastric or cardiac disorders as comprising the major portion of the selective service group. How much the ingestion of food is associated with emotional complex material can be elicited and more easily comprehended when we discover that almost every despised article of diet is tied up with a childhood neurosis or with the social pattern.

A dramatic example of this was seen in an individual who said that he would be perfectly willing to go into the army if they would put him on a special diet. He was asked the nature of this special diet and it followed the usual pattern of a bizarre menu. When asked what he did about his present food, for he worked in a plant where the kind of food that he thought he could eat was not available, he replied that his mother prepared for him the articles of diet which he thought digestible, such as boiled potatoes, boiled "red" meats and chicken. He was asked whether his mother prepared special foods for herself, and his answer was "No, she has to be on the same diet that I am on." Further examination revealed that this man was closely identified with his mother and that she undoubtedly had an organic gastric complaint, but the two had assimilated similar symptoms and were eating identical meals.

I should like to report other interesting reactions in two psychotic cases having to do with food habits. The first, in a woman of seventy who was operated on for carcinoma and, after an apparent physical recovery, developed an organic type of psychosis with delirium, confusion, clouding of consciousness, and all the other typical signs. She overcame these symptoms fairly well, considering her age, but after making good contact with her environment so far as orientation and memory were concerned, she still showed emotional changes. Prior to the operation she and her husband had given up their home which she had kept for many years and where she had prepared their meals. The major symptoms that she showed for many months was crying at mealtime. She would come to the table and as soon as food was set before her she would begin to cry. Nothing could be done to stop this no matter what the food was. She would also cry and have to be taken home whenever she would go to the grocery store with her daughters. When I was consulted about this woman, I came to the conclusion that she cried at mealtimes because of the fear of in-

security due to the breaking up of her home. The symptom was brought to the surface by the organic conditions which produced the psychosis. More as a check than as a deliberate therapeutic measure, it was suggested that steps be taken to re-establish the home even though it was felt by her children that she was not in a condition to manage it. As soon as she saw her furniture set up in an apartment, and as soon as she had the responsibility of providing meals, all of her untoward symptoms disappeared and she made a surprisingly good adjustment thereafter.

The other case is a paranoid schizophrenic who was diagnosed as suffering from this condition for many years. His symptoms and attitudes had never been sufficiently bad to warrant commitment to a mental hospital, but because of an occasional episode where he spoke in a vindictive fashion he had been examined twice by psychiatrists and on one occasion was treated for a few weeks in a desultory fashion extra-institutionally. After he had been a known schizophrenic for about thirty years, he quarreled with some boys resulting in his arrest and reference to the clinic. He insisted that he belonged to a peculiar biblical cult of which he was the only member in the world and that he must follow the Bible exactly. He did not cut his hair; he did not shave, and he did not drink coffee or use sugar. Although he had this beard and bizarre appearance for many years, he never created enough of a disturbance in the community to attract attention. He had become a property owner and managed his property with a considerable degree of astuteness. He made his living by selling newspapers. He maintained that he had written a book about the Bible and that he was ordained by God to write a new biblical commentary. All the bizarre conduct that he exhibited such as growing a beard, leaving his hair uncut, he was able to justify by biblical quotations for he knew his Bible well. Strangely enough, nowhere in the Bible could he find restrictions against sugar and coffee which were undoubtedly unknown to the ancients. After going into the situation with him thoroughly it appeared to me that this man's rejection of those foods had come on significantly only after food rationing went into effect. It may have been that he did not drink coffee for a longer time than that, but certainly his rejection of sugar and sweet things had commenced only about a year back. In addition, he told about a bizarre diet that he had to follow under which he could have meats on certain days of the week and fish on other days. The rules of his cult were not those of any other religious group which has food regulations. He was not confined to fish on Friday nor was he forbidden to eat pork. The whole bizarre religious picture came to the front in a discussion of his dietary plan, about where the rules came from, why he must abide by them, and what he imagined the effect might be were he to violate his own dietary laws.

Summary

The conclusion to be drawn from the application of a dietary questionnaire to patients is that, as naturally would be expected, food is a matter of primary interest to all patients. It can also be seen that the abnormal mental mechanism exhibited by a patient may present itself by way of a nutritional symptomatology and that there is a possibility that the conditions which cause inferior nutrition also are those which cause social maladjustment and even mental disease. A study of food interests, habits, and attitudes reveals mental mechanisms which have marked significance in the clinical picture of individual cases.

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STAY IN THE FIGHT — HOLD THE WAR BONDS YOU BUY

Uses of Barbiturates Intravenously in Neuropsychiatry*

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It has long been known that following the administration of an anesthetic to a psychotic patient there would be a brief period during which the patient was lucid and free from psychotic symptoms. The ameliorating effect is not at all specific as it may occur following inhalation of carbon dioxide, or of nitrogen, or the use of sodium amytal. A similar response can be obtained by the intravenous injection of pentobarbital, evipal, sodium pentothal or sodium thioethamyl.

This non-specific effect in the psychoses has been utilized in various ways. If the ultra-short-acting drugs, sodium pentothal and sodium thioethamyl, are used, any degree of hypnosis can be obtained and maintained for a considerable period of time by moderate injections from time to time as necessary. In the hypnotic state patients are usually highly suggestible. Therefore, resistive and combative patients can be more easily fed, bathed and cared for. When one catatonic schizophrenic refused to eat he was given an injection of a 5 per cent solution of sodium thioethamyl at mealtime and a tray was offered with positive encouragement to eat. He ate willingly. The next meal he had relapsed to his former state and the procedure was repeated. He again ate willingly. After three such treatments he no longer refused to eat. There was no specific alteration of his profound schizophrenic illness.

Harris and associates[1] in 1939, and Gottlieb and Hope[2] published their results on the prognostic value of the intravenous administration of sodium amytal in cases of schizophrenia. They concluded that the type of reaction to sodium amytal based on the warmth of effect and change in mental status was indicative of the prognosis for a given patient. All patients with a good reaction to sodium amytal recovered. They add that the more closely the patient's behavior approaches normal under the influence of sodium amytal, the better the prognosis. Intravenous sodium pentothal and sodium thioethamyl have also been used by the author and reported in another paper.[3] Thus it can be seen that intravenous barbiturates offer a rapid method of approach to the psychotic patient. If conflict material is unobtainable due to lack of rapport, mutism or excitement, intravenous barbiturates offer a short-cut. The technic consists of slowly injecting the drug until the patient responds to questions. Then the injection is discontinued and whatever line of questioning and psychotherapy is indicated may be utilized. Ordinarily there is little clearing with the organic brain syndromes and toxic states, the patient merely becoming more confused. The use of barbiturates in these cases may, however, produce material of diagnostic importance.

Psychological studies are frequently desired on psychotic patients who cannot cooperate. Kelly and associates[4] reported on the use of intravenous sodium amytal as an aid to the Rorschach test. They found that readable psychograms could be obtained with the aid of sodium amytal. However, the test had to be carried out quickly before the patient became too drowsy. The need for rapid testing does not occur with sodium pentothal or sodium thioethamyl as these ultra-short-acting drugs are excreted and/or destroyed so rapidly that any necessary level of hypnosis can be maintained. Unfortunately the diagnostic significance of the Rorschach with the patient under hypnosis may vary. Many of the patient's symptoms are in abeyance, anxiety is greatly reduced and these factors may not be shown on the psychogram. For example, a catatonic schizophrenic girl who was mute and antagonistic was given 5 cc. of a 5 per cent solution of sodium thioethamyl and a Rorschach was done. The basic conflicts in the case were of a sexual nature and her fantasy life was highly sexual in content. However, her response to the Rorschach cards showed none of this content. Superficially, the psychogram approached normal, but showed rigidity and constriction of the intellectual sphere. She exhibited a good potential emotional reaction

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and was affectively extratensive according to the analysis of her responses. There were no bizarre responses such as are seen in many schizophrenic records. It was felt that the psychogram did not reflect the personality changes that had taken place, but approximated what might have been the response if the patient were socially adjusted.

Horsley[5] in 1936 introduced the term "narcoanalysis" for the use of a sedative which produces diminution of the conscious state and a release of the inhibitory processes, in order to determine the conflicts of the patient and to allow psychotherapy to be given with the patient in an increased state of receptiveness. Many of the barbiturates have been recommended for this procedure. Horsley felt that nembutal, evipal and pentothal were closest to the ideal. To this group has since been added sodium thioethamyl. With these drugs a state of optimum suggestibility can be produced very quickly and prolonged indefinitely. Following the induction of the hypnotic state, analysis can be carried out by any practical method. Synthesis is the essence of the procedure. With experience simple cases can be benefited by one treatment. More complicated or resistant cases may need the use of post-hypnotic suggestion and further treatment. Post-hypnotic effect is reinforced by explanation and re-education.

In 1938 Campbell[6] recommended the post-anesthetic period for the greatest psychotherapeutic effectiveness. He used evipan and reported on 15 patients of whom 7 showed marked improvement. He calls attention to the chemical production of a state analagous to deep hypnosis. Many cases have been reported in which intravenous barbiturates were used in the above described fashion. In 1937 Eaton and O'Leary[7] reported the "cure" of dermatitis factitia in a 14-year-old girl by means of inquiry and therapy carried out with the aid of sodium amytal.

Gold and Garofalo[8] report recovery from a functional aphonia under pentothal sodium with no recurrence after ten months follow-up. Livingstone and Light[9] describe recoveries in two cases, one of combined hysterical amblyopia and aphonia, the other of hysterical deafness, anosmia and loss of taste. They used intravenous pentothal. Somerfield and Tovell[10] encountered a case of hysterical paralysis which recovered after the administration of pentothal sodium intravenously combined with suggestive psychotherapy. Stungo[11] used evipan as an adjunct to investigation and treatment of psychiatric out-patients and states that the drug can be used to treat hysterical amnesia and hysterical paresis without psychotherapy. He reports no follow-up.

In 1942 Wilde[12] wrote on the use of pentothal hypnosis in the treatment of war neuroses in 50 soldiers. In his experience it is useful in treating hysteria, anxiety states and the after effects of injuries to the head and spine. When the diagnosis is in doubt it is a useful diagnostic tool in borderline psychoses, mental deficiency and epilepsy. It has also been effective in uncovering simulation and malingering. He considers pentothal hypnosis a rapid and safe method of psychotherapy.

The experiences of Lt. Colonel Grinker[13] and co-workers during the Tunisia campaign were described in a report rendered before the Brief Psychotherapy Council which met recently and these are further evidence of the value of the ultra-short-acting barbiturates. Pentothal sodium was administered intravenously in patients suffering from acute anxiety states associated with mutism, stupor, regressive symptoms and amnesia. The drug was injected slowly (0.1 gms. per min.) until a satisfactory level of narcosis was reached. The traumatic experience was then reviewed with or without verbal stimulation on the part of the therapist. This mode of therapy was named narcosynthesis as it helped the patient to synthesize the traumatic experience and the associated emotions which had become fragmented. Under pentothal the patients' ego is allowed to deal with the acute anxiety produced by the traumatic situation in a rational and economical fashion. There occurs a controlled release of repressed emotions in quantities small enough so that the weakened ego resumes its rationalizing function. Grinker's explanation of the treatment corroborates Horsley's conclusion that synthesis is the essence of the procedure. However, the first reaction of pentothal according to Grinker is that of overcoming psychic resistances, synthesis being a second phenomena that takes place when the repressed emotions are released in relation to the recapitulation of the traumatic situation.

In our hands sodium pentothal and sodium

thioethamyl have given the best results. The very short action of these drugs lessens the need for nursing care over any period of time. The rapid destruction and excretion of the ultra-short-acting barbiturates promotes rapid recovery from the hypnotic or narcotic state to full activity. There are several factors which make this type of treatment rapidly effective. The release of inhibitory processes and the increased receptiveness of the patient are of course important. However, these factors lead to the rapid establishment of rapport and a positive transference often can be obtained in a very short time. Insight can be established readily by persisting in discussion of the conflict material until the patient is fully awake. If repressed material, which is abnoxious to the waking state, is reproduced, amnesia can purposefully be obtained by carrying the patient to the point of anesthesia after the hypnotic state has been utilized. Further treatments can be given to achieve gradual release of repressed material accompanied by desensitization. Material which has traumatic significance to the patient can be recognized since the hypnotic state does not inhibit the usual manifestations of anxiety, such as increase in pulse and respiratory rate with frequent sighing. Because of the brief duration of action of the ultra-short-acting barbiturates it is feasible to vary the state of consciousness as needed during the psychotherapeutic interview. Such a degree of flexibility cannot be obtained with the short actors, pentobarbital and amytal. Failure to obtain desired results with the ultra-short-acting barbiturates is usually due to over rapid injections. Because relatively small amounts of the ultra-short-acting drugs produce marked changes in the state of consciousness, careless and inattentive injections not only fail to produce the desired level of consciousness, but may be dangerous.

The following case is an example of the marked results obtained in what might otherwise have been a difficult case:

J. B., white, unmarried, female, age 19, was brought to the office by her parents on the recommendation of an otolaryngologist who found no organic cause for an aphonia of three months duration. History from the parents and an interview with the patient revealed no source of conflict. Since the patient had lost her voice she had complained of mild fatigue and had lost interest in social activities. She was intelligent, superficially stable and well adjusted in her position as bookkeeper.

The patient was given 17 cc. of a 5 per cent solution of sodium thioethamyl over a 20-minute period. In the drug induced hypnotic state the patient revealed an intense attachment for an uncle six years older than herself. This uncle had been killed during army maneuvers five months before the onset of aphonia. The patient had been able to grieve with the family at the time of the tragedy but following this she inhibited her desire to talk about her uncle, realizing the unfitness of her love for her mother's brother. Neurotic tension increased and with severe repression of the desire to talk about the uncle came repression of the voice function. As the patient ventilated her attachment for the uncle, voice function returned. As she awakened she was encouraged to talk about her problem. One hour from the time she began treatment she was dismissed to return for further psychotherapy. Two subsequent psychotherapeutic sessions were utilized for the development of adequate insight and re-education. These were carried out without further administration of barbiturates. Follow-up shows no recurrence of symptoms.

Summary

The ultra-short-acting barbiturates have been used in hypnotic doses in psychotic states as an aid in ordinary nursing care, to aid in feeding, to obtain conflict material and psychograms, and as prognostic agents. They have been found of value and the long period of drowsiness which follows the use of sodium amytal and pentobarbital has been avoided.

The intravenous administration of ultra-short-acting barbiturates for the purpose of producing a hypnotic state is described.

Barbiturate induced hypnosis may be utilized for release of inhibitory processes, analysis, synthesis and post-hypnotic suggestion. In difficult cases amnesia for traumatic recollections may be regulated according to the patient's needs.

Treatment of a case of hysterical aphonia is described.

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Neurological Clinical Pathological Conference

of the

Cincinnati General Hospital

CHARLES D. ARING, M.D., *Editor*

CASE NO. 145038

Presentation

A 45 year old white man, who worked as a dry cleaner, was admitted to the Psychiatric Service of the Cincinnati General Hospital on June 13, after becoming unmanageable in a private institution, where he had been for 12 hours. The patient had had grand mal and petit mal seizures for ten years; the attacks had begun eight years after a brain injury. He had been first seen by a physician because of the convulsions two years before his final illness; bromides had been prescribed and taken indifferently. This doctor had administered weekly injections of ½ grain of sodium cacodylate without surcease for two years, the last injection was administered on June 1, twelve days before his admission to the hospital.

For six months progressive memory disorder was observed by both the physician and the patient's wife. Increasing irritability had been present for several weeks, and paranoid ideas for ten days. The patient had noted that he was getting poison instead of medicine. On June 12 he became disoriented and unmanageable and at 3 A. M. on June 13 he was removed to the private hospital when relatives became unable to cope with him. At that hospital he was given ¼ grain of morphine, and 4 grains of sodium phenobarbital (hypodermically).

No examination was done at the private hospital. A physician noted that the patient was mute and as if in a "frozen panic," when he saw him at about 10 A. M. on June 13. This physician and several nurses recorded extreme diaphoresis.

At the initial examination at 3 P. M. on June 13 at the Cincinati General Hospital the patient was pale, lips and nails cyanotic, and the body was covered with profuse perspiration. The rectal temperature was 105.6 degrees F., the pulse rate was 156, and respirations 32 per minute. He was restless, thrashing about wildly, seemingly moving the right extremities more vigorously than the left. Some of the movement appeared to be involuntary, and at times he assumed rigid attitudes with staring. It was difficult to establish contact with him since he was extremely apprehensive, and was having visual and auditory hallucinations. It was possible to learn during brief moments of relative calm that he knew his name, the name of the city, but that he

was disorientated as to time. He cried out warnings, and shouted single words repeatedly.

Other abnormal findings on the admission examination were numerous fresh bruises about the extremities; he grasped objects with the right hand but would not respond to pinprick; and the deep reflexes were not obtained.

Supportive therapy was instituted. During the 24 hours after admission, the thrashing movements of the extremities continued. One observer considered the movements to be myoclonus, since they were most likely involuntary occurring in bursts of from 3 to 5. They were rapid and moved the limb segment through wide ranges. They were more marked in the right extremities and were accentuated somewhat during phases of acute excitement. Under barbiturate sedation with the patient unresponsive, the only deep reflexes obtained were the knee jerks. A few hours later the knee jerks had again disappeared.

His rectal temperature was reduced rather promptly to 102 degrees with tepid sponging, but it mounted again during 24 hours, to reach 106 degrees terminally. The pulse followed the temperature, never dropping below 120 and finally rising to 150. The respiratory rate rose steadily from 32 to 64. The blood pressure was 110/80 at entry and soon fell to 70/60. He had prolonged bouts of hiccoughing during the 12 hours preceding death. Alternating between excitement and stupor, the latter becoming increasingly prolonged, he lived only 47 hours after admission, dying on June 15.

Laboratory Data: Catheterized twice, 150 cc. of urine was obtained on June 13, and 20 cc. on June 15; this represented the total urinary output during the period in the Cincinnati General Hospital. The urine contained much albumin, and red and white blood cells and casts. (There was no record of blood counts which were undoubtedly done.) The blood Kahn was negative. On June 13 the blood chemistry was reported as follows: sugar 58 mg., chlorides 614 mg., bromides 100 to 125 mg., urea nitrogen 25 mg., calcium 4.3 mg. %, and CO_2 combining power 22 vol. %. On June 14 the urea nitrogen was 46 mg.% the CO_2 combining power was 31 vol.%; on June 15 the CO_2 combining power was 30 vol. %. The initial pressure of the CSF was 110, the fluid resembled water, and contained 9 lymphocytes per cmm., and 19 mg. % protein. The CSF Wassermann was negative.

Differential Diagnosis

Dr. George Engel: The differential diagnosis in this case certainly is simplified by an unusual combination of symptomatology which almost forces one's hand. One is dealing with a person who develops acute involvement of the central nervous system and an apparently acute involvement of the kidney, surely an unusual combination. There are relatively few circumstances under which one sees this. For that reason I think the most economical way of considering the differential diagnosis is to elucidate the nature of the involvement of the central nervous system and of the kidney, and to consider the circumstances under which this simultaneous difficulty might occur.

There is mention of such vague symptoms as changes in memory, paranoid ideas, etc., going on for weeks and months. These, I am going to pass over for the moment. I am going to start consideration of the case at the point where the patient develops the acute delirium. The neurological findings are not of particular localizing value. Indeed, one gets the impression that this patient developed diffuse involvement of the central nervous system, although perhaps a type of involvement that suggests multiple focal lesions rather than diffuse involvement in the strict sense of the word. At least there is some suggestion from the protocol that the changes were more striking on one side of the body than the other. The course of this acute encephalopathy indicates a fulminating process. The patient dies with fever, and dyskinesias which indicate sub-cortical lesions and perhaps involvement of even deeper structures. The burst of hiccoughing also would be consistent with that.

There was striking abnormality of renal function, oliguria, anuria, hematuria, albuminuria, pyuria, and cylindruria. There is no mention of the specific gravity of the urine, and presumably that is not available. So we have the laboratory and clinical findings of an acute toxic nephrosis or acute glomerulonephritis. As one scans the blood chemistry one finds confirmation; the urea nitrogen was within the upper limits of normal. For the two days that he lived the blood urea nitrogen

rose further, suggesting the acute development of renal insufficiency, reaching the point of urea nitrogen retention at the time the patient came into the hospital. The CO_2 combining power was also consistent with renal insufficiency. There was a low blood calcium, 4.3 mg. per cent, which I hesitate to discuss in the absence of blood phosphate levels. With renal insufficiency of long-standing one often sees rising phosphate and falling calcium, but in the absence of more data I don't feel justified in laying much stress on that figure.

Now let us go back and consider the possibilities that might be responsible for the simultaneous involvement of both kidney and brain. Could the involvement of both the kidney and the central nervous system be a purely fortuitous occurrence. I think this too unlikely to warrant consideration. Then one might speculate "Is there any acute lesion of the central nervous system which leads to involvement of the kidneys as a complication?" I don't know of any. Is there any acute lesion of the kidney which may produce acute changes in the central nervous system as a complication? That is a relatively common situation. We all know that patients with renal disease tend to develop changes in the central nervous system either secondary to metabolic changes of renal insufficiency or to vascular disease secondary to severe hypertension. This patient did not have uremia, neither did he have evidences of vascular disease. The only renal lesion that might be considered would be acute glomerulonephritis, but there is nothing in this clinical picture that suggests glomerulonephritis. Further the changes in the central nervous system are far too fulminating and out of proportion to the changes in renal function. Thus I think we can pass on with some assurance that we are not dealing with primary renal disease.

We are left then with a situation in which both brain and kidney are damaged simultaneously, and one thinks immediately of a toxic material that has a peculiar tendency to damage both brain and kidney. What are the possibilities? One group of drugs which often provokes an acute encephalopathy and an acute renal picture are the sulfonamides. Patients come into the hospital with acute and severe delirium, lapse into coma, show a variety of changes in renal function, high fever, and die within a day or two. Sometimes we get a history of sulfonamide intake. In some patients we do not have such a history. A patient developing gonorrhea often will take a sulfonamide and due to the nature of the infection he may not mention this to the family. When such patients are admitted to the hospital in coma, the family may know nothing of the ingestion of sulfonamides. However, I see nothing to support such a possibility here, and since there are other toxic materials to which the patient may have been exposed, we shall go on.

The patient worked as a dry cleaner. We know nothing about the size or nature of the establishment in which he worked, or of the material to which he was exposed. The hazards of dry cleaning are carbon tetrachloride and other halogenated hydrocarbons. When inhaled, carbon tetrachloride is known to produce central nervous system changes and a toxic nephrosis. Also acute hepatitis or acute yellow atrophy may develop when the material is ingested. I went through the literature on carbon tetrachloride to see whether any fulminating, delayed encepalopathy may occur as the result of its inhalation. All the data I found indicated that when inhaled, carbon tetrachloride acted primarily as an anesthetic. The patient usually is overcome on the spot. If the concentration of vapor is high where he falls, he may die. If exposed to low concentrations or if removed from the zone of high concentration, he may suffer headache, dizziness, vomiting, confusion, and blurring of vision. But as the material is excreted during periods of breathing fresh air, the nervous symptoms gradually disappear, and I was unable to find any case in which delayed symptoms developed. The renal complications on the other hand are usually delayed. The patient may be exposed to the material, developing acute central nervous system involvement, and some days later oliguria develops, the urine shows red cells, white cells, casts, and albumin, while urea nitrogen rises. In many respects the picture resembles that seen with bichloride of mercury poisoning, that is, an acute toxic nephrosis. Because we do not have any clearcut evidence that this man was exposed to tetrachloride and because of the delayed development of acute involvement of the central nervous system occurring simul-

taneously with the toxic nephrosis, I was inclined to believe this was not the diagnosis.

There is another material to which this patient was exposed that causes changes in the central nervous system and kidney. It is mentioned that this patient received sodium cacodylate for more than two years. This is a pentavalent organic arsenic compound which has been used as a tonic for many years, long preceding the use of the trivalent arsenicals. It was used at a time when not much was known about the toxicology of arsenic. This compound is ordinarily given parenterally in doses of 200 mg., but orally the doses are very much smaller, about 30 mg. In the gastro-enteric tract this compound is broken down into free arsenic and this is one of the rare situations in which a drug is more toxic by mouth than parenterally. This man received this material over a long period of time and one wonders why after two years he should develop any acute symptoms related to arsenic, particularly when one considers that he was receiving relatively small doses.

As all of you know, the organic arsenic compounds, neoarsphenamine, etc., have the property of producing an acute type of encephalopathy, so-called hemorrhagic encephalitis or brain purpura. Here the reaction involved is apparently more than the direct toxic action of arsenic per se; there is some type of hypersensitivity reaction in which there is some reason to believe that the vascular system is the point of major involvement. In the literature concerning the arsenicals used in the treatment of syphilis, there is general agreement that acute arsenical encephalopathy generally develops some time after the second, third, or fourth injection. The symptoms develop abruptly, usually within a matter of 24 to 60 hours after injection of drug, the syndrome is fulminating, and the great majority of patients die. As the patient receives increasing number of injections, this syndrome becomes increasingly infrequent, and cases after the ninth injection are very rare. Roseman and Aring[1] reported a case developing after the fifteenth injection, Rabiner, Freiman and Apter[2] reported one after the forty-fifth injection of mapharsen.

When one reads the literature on this syndrome several authors state that involvement of other tissues is unusual. Reading the protocols of some cases, that conclusion seemed forced since a number of patients had red cells, white cells, and albumin in the urine, suggesting a diffuse vascular type of reaction, involving kidney as well as brain, if not other tissues.

Are we dealing with acute arsenical encephalopathy? That is a very difficult thing to say. I was unable to find any record in the literature of this syndrome developing as the result of sodium cacodylate therapy, although I was unable to go through the older literature at which time sodium cacodylate was more commonly used. Even now it is still used and one does not hear of this type of reaction developing. Is it possible to suggest other ways in which the arsenic was involved? Could we be dealing here with direct effect of arsenic? One might wonder whether this patient receiving the drug over a long period of time had not been slowly developing renal damage so that over a period of time arsenic concentration built up to a high level. This possibility intrigues me somewhat. It would then be possible to explain why this patient developed subtle and distinct involvement of the central nervous system, before he developed acute encephalopathy. Arsenic is a material that interferes with the intracellular enzyme systems and would be expected to have effect on intracellular metabolism and one might visualize gradual damage to individual cells in the brain. Then for reasons we do not understand there developed the more acute type of hypersensitive reaction that we know as arsenical encephalopathy. It is hard for me to explain why this acute encephalopathy should develop after this long interval. Yet the picture as described is so typical of what one reads as that of acute arsenic encephalopathy that I am drawn irresistibly to this diagnosis. Because of the nature of kidney involvement, I feel even more inclined to the view that we are dealing with a syndrome that is primarily the result of arsenic. At post mortem examination we are going to see the changes of an acute toxic nephrosis and the changes in the brain that have been described as those of acute arsenic encephalopathy. Although there was no icterus, changes in the liver may also be present.

I think I ought to say a word about the convulsions. He had had grand mal for ten years, they began eight years after a brain injury. Whether it was post-traumatic epilepsy or

whether he had a lowered threshhold, I do not know. However, the convulsions aid us, I think, in accounting for the changes in the level of awareness. There is no mention of the frequency of convulsions; he may have been experiencing post-seizure confusion, and brain damage related to the epilepsy. He was also receiving bromides and perhaps many of these early symptoms might be related to bromidism. The bromide level was not high, but we do know the blood level of bromide is not well correlated to delirium. It may well be that the level of bromide in this case was of clinical significance.

One point I would like to mention in passing. Again we note the use of morphine injudiciously. The primary indication for morphine is pain. Too many of us have come to equate morphine with restlessness and not with pain because patients with myocardial infarction are frequently restless. They are usually restless because of pain, and under those circumstances morphine is indicated. When pain is absent, morphine may even be contraindicated. I think it is unwise to give morphine to patients with acute disturbance of consciousness.

Dr. Richard Vilter: Does Doctor Engel think that a pentavalent arsenical may produce encephalopathy?

Dr. Engel: We have observed a young woman with arsenical encephalopathy from inception through recovery, after the use of melarsen, a pentavalent arsenical.

Clinical Diagnosis

Toxic nephrosis
Status epilepticus

Doctor Engel's Diagnosis

Toxic changes of chronic arsenic exposure
  Toxic nephrosis
  Toxic hepatosis
  Toxic encephalopathy
Acute arsenical encephalopathy
Epilepsy, ? post-traumatic

Anatomical Diagnosis

Severe toxic nephrosis
Severe toxic hepatosis with diffuse fatty infiltration of the liver.
Severe toxic myocardosis with slight fatty infiltration of myocardium
Acute bronchitis and lobular pneumonia
Polyneuritis
Late post-traumatic vascular changes in the white matter of the cerebrum.

Discussion of Pathology

Dr. I. Mark Scheinker: The gross examination of the brain did not reveal any change except diffuse congestion.

The microscopic examination of the kidney verified Doctor Engel's diagnosis of toxic nephrosis. The kidneys showed widespread congestion of vessels associated with hemorrhage. There was no inflammatory change or scarring. The tubules contained black pigment. The tubular epithelium was markedly swollen and partly degenerated. The liver contained multiple areas of necrosis, mostly around congested vessels. There was definite fatty infiltration chiefly confined to the central portion of the liver lobules.

It was quite surprising to find myelin loss and axis cylinder degeneration in some areas of the peripheral nerves; the lesions were typical of chronic neuritis, degenerative in character.

The findings in the brain were meagre. There were no signs of arsenical encephalopathy. There were found vascular lesions compatible with late post-traumatic change; some of the blood vessels of the white matter were surrounded by tremendously distended perivascular spaces which were filled with connective tissue. There was moderate leptomeningeal thickening. The cortical gray matter was well preserved. The white matter showed in addition to the vascular changes a diffuse swelling of moderate degree. Some of the veins of the paraventricular areas were tremendously distended and showed a moderate degre of congestion.

Dr. Charles D. Aring: Doctor Kehoe will present the toxicological data.

Dr. Robert Kehoe: With respect to analytical findings, it is to be noted that if persons live for ten days after ingestion of arsenic, there is little evidence of this substance in their tissues.

As one examines the analytical data on many organs and tissues in this particular case, it is perfectly clear that this man had retained little arsenic. If he had suffered from an accumulation at any time he lost it during his illness.

The analytical data, per se, in this case do

not support the diagnosis of arsenical encephalopathy. In fact, the only sample that showed unusual arsenic concentration was the hair, where the arsenic content was high in both the proximal and distal portions. It is a little surprising that there was not more arsenic in the skeleton and in the finger nails. On the other hand, considering the behavior of arsenic in the body and the manner in which it was administered in this case, it was to be expected that the overwhelming proportion of the arsenic would have been excreted from the tissues.

Its absence by no means eliminates the possibility that it inflicted damage in transit. For example, it has never been possible to relate the arsenic concentration in the brain to the damage of the encephalopathy that may follow arsenical therapy. It may be that the lesions are induced indirectly, but it seems highly probable that they result from the therapeutic procedure. More pertinently, it often happens in fatal arsenical poisoning (criminal cases) that the agent is lost from the body before death, to such an extent that adequate proof of its administration cannot be obtained post mortem.

Considering the foregoing facts, I should say that the diagnosis in this case must rest upon the clinical and pathological findings. Focal necrosis of the liver with fatty changes, while not specific, are fairly good evidence of arsenic poisoning in this particular case unless some other more reasonable explanation for it were to be found.

The patient died fifteen days after the last injection of sodium cacodylate, which allowed plenty of time for him to get rid of the arsenic that he had had. If a person lives nine to ten days the chances of finding analytical evidence is slight indeed; fifteen to twenty days are enough to eliminate all traces of arsenic from the body except that classed as normal.

Doctor Engel: That this man received one-tenth the usual therapeutic dose of arsenic and still developed peripheral neuritis, would make one wonder whether he wasn't more sensitive to arsenic than ordinarily.

Doctor Milton Rosenbaum: I too was impressed with the arsenical history, yet, if it be ignored, one remembers that epileptics die the same way as did this individual. I think that it would be difficult to prove that this man did not die an epileptic death; in other words, in status epilepticus. Toxic nephrosis may be due to a number of things beside arsenic.

Doctor Engel: Toxic nephrosis of this magnitude is not often seen. I would agree with your impression, and in the absence of toxic nephrosis, status epilepticus would be a reasonable diagnosis.

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COLONEL MENNINGER WINS LASKER AWARD

An Army doctor who did much toward helping the enlisted man understand his own emotional reactions to battle, was given national recognition today by the National Committee for Mental Hygiene at its 35th annual meeting in the Hotel Pennsylvania.

The occasion was the first Lasker Award for outstanding service in the field of mental hygiene—an award of $1,000 established by the Albert and Mary Lasker Foundation, Inc. —and the recipient was Col. William C. Menninger, chief consultant in neuropsychiatry in the office of the Army Surgeon General in Washington.

The presentation was made by Brig. Gen. Raymond W. Bliss, assistant Surgeon General of the U. S. Army. He paid high tribute to this officer, a veteran of two wars.

His achievement which won the Lasker Award was the organizing of a wide-scale program of aiding battle-weary men to recover more quickly from mental upsets.

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